

UNITARY LIFT GATE

This is a continuation-in-part of U.S. Patent Application Serial No. 09/811,237 filed on March 15, 2001.

Field of the Invention

5 The present invention generally relates to an apparatus for carrying loads between two levels and in particular relates to a lift gate for lifting and lowering loads between ground level and the payload level of a vehicle.

Background of the Invention

10 Lift gates are typically mounted at the rear of trucks, truck trailers and the like to bring payloads from ground level up to the truck bed or from the truck bed to the ground. In some applications, it is desirable to configure the lift gate so that it folds away when not in use. Examples of such
15 designs are the cantilever Tuk-A-Way® lift gates available from Maxon Lift Corporation (11921 Slauson Avenue, Santa Fe Springs, CA 90670). Typically, these lift gates employ parallelogram linkages to maintain the lift gate in a horizontal plane through the lifting range. The lift gate is
20 attached to the parallelogram linkages by pivot members, which allow the lift gate to be placed in a generally vertical position when in the lowered position. When in the vertical position, operation of the lifting mechanism rotates the lift gate into an inverted, stowed position beneath the vehicle
25 body.

Prior art Tuk type cantilever lift gates present various challenges having to do with their shipping and installation. All prior art Tuk type cantilever lift gates mount to the vehicle chassis. Thus, these lift gates are
5 susceptible to misalignment with the vehicle body. When misaligned, operation of the lift gate can exert differential force on the vehicle body, tending to separate them. Further, typical cantilever lift gates, when shipped from the factory, are partially disassembled and have awkward shapes, requiring
10 substantial packaging. Further, proper installation necessitates that several of the components must be precisely aligned and then securely mounted to the vehicle. Moreover, the lift gate must be fitted to the vehicle only after the vehicle body has been attached to the chassis. Consequently,
15 proper installation of prior art lift gates involve significant time and expense.

Furthermore, in prior art lift gate designs, lift platforms may become misaligned with the vehicle body. When the misalignment becomes severe, operation of the lift gate
20 can exert a differential force on the vehicle body, causing it to separate from the vehicle chassis.

Accordingly, it would be advantageous to have an apparatus for lifting loads that is convenient and simple for shipping and installation. It would also be advantageous for
25 the apparatus to have high overall strength and reliability. It would be of further advantage for the apparatus to be easily adaptable for various vehicle configurations.

Brief Description of the Drawings

Figure 1 is a perspective view illustrating a unitary lift gate a stowed position in accordance with the present invention;

5 Figure 2 is a perspective view illustrating the lift gate of Fig. 1 in a lowered position with a lift gate platform in a vertical orientation;

 Figure 3 is a side view illustrating the lift gate of Fig. 1 with the lift gate platform in the lowered position
10 with the lift gate platform in a horizontal orientation;

 Figure 4 is a perspective view illustrating the lift gate of Fig. 1 in a raised position with the lift gate platform in the horizontal orientation;

 Figure 5 is a side view illustrating the lift gate of
15 Fig. 1 in a raised position with the lift gate platform in the horizontal orientation;

 Figure 6 is a perspective view illustrating the lift gate of Fig. 1 secured to a portion of a vehicle body in accordance with the present invention; and

20 Figure 7 is a perspective view illustrating a plurality of fully assembled unitary lift gates stacked together in accordance with the present invention; and

 Figure 8 is a perspective view of a frame adapter in accordance with the present invention.

Detailed Description of Various Embodiments

Various embodiments of the present invention are described hereinafter with reference to the figures. Elements of like structures or function are represented with like
5 reference numerals throughout the figures. The figures are only intended to facilitate the description of specific embodiments of the invention. They are not intended as an exhaustive description of the invention or as a limitation on the scope of the invention. In addition, an aspect described
10 in conjunction with a particular embodiment of the present invention is not necessarily limited to that embodiment and can be practiced in conjunction with any other embodiments of the invention.

Figures 1-7 illustrate a unitary lift gate 10 in
15 accordance with the present invention. Lift gate 10 is used for lifting loads between a low level, e.g., ground level, and a high level, e.g., a truck bed level. Lift gate 10 has a cantilever lifting mechanism. Accordingly, lift gate 10 is also referred to as a cantilever lift gate or simply a load
20 lifting apparatus. The structural members of lift gate 10 are preferably formed from steel, but other metals or composite materials can be suitable depending upon the intended application.

Lift gate 10 includes a unitary frame 12 having an
25 opposing pair of side plates 14. A trunnion bar 16 and an extension plate 18 extend between side plates 14. A plurality of holes or orifices 17 are formed in each of side plates 14 adjacent an upper edge 19 thereof.

A pair of brackets or frame adapters 71 are removably attached to pair of side plates 14 near upper edges 19. Each of frame adapters 71 has two segments or sections. A perspective view of frame adapter 71 is shown in Fig. 8. A first section 72 is configured for attaching to a platform, e.g., a vehicle bed 66 as shown in Fig. 6. Holes 73 may be formed in first section 72 to attach frame adapter 71 to cross members 62 in vehicle bed 66 using bolts. First section 72 of frame adapter 71 can also be welded to vehicle bed 66. A second section 74 has a plurality of apertures 75 formed therein. Bolts 76 can be used to attach frame adapters 71 to side plates 14 through apertures 75 and orifices 17. In a preferred embodiment, apertures 75 are elongated slots that are oblique or perpendicular with respect to first section 72. Elongated slots allow the adjustment of the position of unitary frame 12 with respect to vehicle bed 66.

Lift gate 10 also includes a lift frame 21 that has a lift frame bar 22 extending between an opposing pair of parallelogram linkages 24. Each parallelogram linkage 24 includes an upper arm 26 and a lower arm 28, and a proximal pivot member 31 and a distal pivot member 32. Proximal pivot members 31 are attached to trunnion bar 16 thus securing lift frame 21 to unitary frame 12. Preferably, trunnion bar 16 comprises integral mounts 34 for attaching proximal pivot members 31.

A tower 36 is mounted on trunnion bar 16 of unitary frame 12. A hydraulic cylinder actuator 38 is pivotally attached at one end to tower 36 and at another end to lift frame bar 22. Tower 36 is also referred to as an actuator mount. A lift gate platform 41 is secured to distal pivot

members 32 of parallelogram linkages 24. In operation, lift gate platform 41 carries the load. Lift gate platform 41 is also referred to as a load carrying plate. Hydraulic cylinder actuator 38 extends and retracts to raise and lower, respectively, lift gate platform 41 through lift frame 21. Parallelogram linkages 24 maintain the orientation of distal pivot members 32 with respect to proximal pivot members 31 as upper arms 26 and lower arms 28 are raised and lowered. Retraction of hydraulic cylinder actuator 38 drives lift frame bar 22, rotating upper arms 26 and lower arms 28 about proximal pivot members 31 to lower lift gate platform 41. Conversely, an extension of hydraulic cylinder actuator 38 raises lift frame bar 22.

Lift gate platform 41 is rotatably attached to distal pivot members 32. Lift gate 10 is also referred to as a cantilever lift gate, wherein the term cantilever refers to lift gate 10 having lift gate platform 41 supported at one end only by the pivotal attachment to distal pivot members 32. Motion limiting tabs 44 are attached to lift frame 21 adjacent distal pivot members 32 to prevent a rotation of lift gate platform 41 away from upper and lower arms 26 and 28 beyond a horizontal orientation. This keeps lift gate platform 41 in a plane parallel with the ground and vehicle bed 66 of a vehicle 60 to facilitate loading and unloading, as shown in Figs. 3, 4, and 5. On the other hand, lift gate platform 41 may be rotated at distal pivot members 32 toward upper and lower arms 26 and 28 to a generally vertical orientation as shown in Fig. 2. In this orientation, an extension of hydraulic cylinder actuator 38 raises and inverts lift gate platform 41 into a stowed position as shown in Figs. 1 and 6.

In a preferred embodiment, lift gate platform 41 is equipped with a lift gate platform extension 48 attached by hinge 49, creating a bifold configuration. Hinge 49 allows lift gate platform extension 48 to fold against lift gate platform 41 toward parallelogram linkages 24, and prevents lift gate platform extension 48 from rotating away from parallelogram linkages 24 beyond the plane of lift gate platform 41. Lift gate platform extension 48 provides an increased load carrying area. When lift gate platform 41 is placed into the vertical position shown in Fig. 2, lift gate platform extension 48 folds back against lift gate platform 41, thereby providing a compact profile for storage. In other embodiments, more additional platform extensions may be provided creating a multiple fold configuration.

In accordance with various embodiments of the present invention, unitary frame 12 may include a variety of additional features to simplify the manufacture and to increase the utility of lift gate 10. For example, side plates 14 may comprise formed steps 51, pump bracket 52 for mounting pump 54 to power hydraulic cylinder actuator 38, dock bumpers 56 and vehicle light brackets 58. These features are integral with the unitary frame 12. However, they can also be separate members that are suitably attached to unitary frame 12. In a preferred embodiment, lift frame bar 22 is configured to function as an underride guard to minimize injury in the event of a rear end collision. Integrating underride protection into the existing lift gate system removes the need for an additional, dedicated horizontal underride protection member.

Figure 6 shows lift gate 10 attached to vehicle 60. In this arrangement, lift gate 10 carries loads between the ground level and vehicle bed 66 of vehicle 60. In accordance with a preferred embodiment of the present invention, frame adapters 71 are secured to cross members 62 at the underside of vehicle bed 66. In a preferred embodiment shown in Fig. 6, first sections 72 of frame adapters 71 are secured to vehicle bed 66 by bolts 64 through holes 73 therein. However, welding or other means of attachment can also be used. Frame adapters 71 securely attach unitary frame 12 of lift gate 10 to vehicle 60. Apertures 75 formed in second sections 74 of frame adapters 71 allow an adjustment of the position of unitary frame 12 with respect to vehicle 60. Preferably, elongated and oblique apertures 75 allow the position of unitary frame 12 to be adjusted so that extension plate 18 is substantially coplanar and flush with vehicle bed 66 of vehicle 60. Once a desired position is achieved, fastening devices, e.g., bolts 76, are tightened to secure lift gate 10 to vehicle 60.

In accordance with the present invention, all components in lift gate 10 are attached to unitary frame 12, only unitary frame 12 needs to be attached to vehicle 60 via frame adapters 71. No alignment or adjustment of the lifting mechanism is necessary. Further, the unitary construction of lift gate 10 allows it to be attached to a wide variety of truck types. Typically, the only adjustment necessary is to level extension plate 18 with vehicle bed 66. This is easily accomplished by adjusting unitary frame 12 with respect to frame adapters 71 as described above, thereby aligning extension plate 18 with vehicle bed 66. The present invention

allows integrated lift gate 10 to be fully pre-assembled, requiring only final bolt-on attachment to a vehicle body with little or no adjustment.

The integrated, unitary and compact nature of lift gate 10 in accordance with the present invention also facilitates shipping, packaging and storing. Unitary frame 12 with lift gate platform 41 in the stowed position presents a compact, box-like profile that may be stored or shipped with virtually no packaging.

Further, multiple lift gates can be stacked and bolted together, as shown in Fig. 7, for shipment, thereby avoiding or minimizing the need to use pallets, banding material, or other packaging means. In one embodiment, the bottom profile of side plates 14 is configured to nest with the top profile of frame adapters 71 on the tops of side plates 14 and extension plate 18. This allows a stack of multiple lift gate units to be very stable and allows them to be easily secured together, by bolts or other suitable means. In another embodiment, frame adapters 71 are removed from unitary frame 12 when the multiple lift gates are stacked together. In this embodiment, the bottom profile of side plates 14 is configured to nest with the top profile of side plates 14 and extension plate 18.

Unitary cantilever lift gate 10 that attaches to the vehicle body rather than the vehicle chassis offers numerous benefits compared with prior art lift gate designs. First, lift gate 10 may be completely assembled and fully tested at the factory prior to being delivered for installment. This greatly improves quality control and simplifies installation. Lift gate 10 needs only be secured to the vehicle body by

welding, bolting or other means, dramatically reducing the installation time required. Furthermore, because lift gate 10 is secured to vehicle 60, lift gate platform 41 will always be in alignment with vehicle bed 66. In prior art lift gate designs, lift platforms may become misaligned with the vehicle body. The operation of a severely misaligned lift gate may exert a differential force on the vehicle body, causing it to separate from the vehicle chassis. Lift gate 10 in accordance with the present invention completely avoids such problems.

By now it should be appreciated that a load lifting apparatus, i.e., a unitary lift gate, has been provided. The apparatus in accordance with the present invention is a pre-assembled, unitary Tuk type cantilever lift gate configured to be secured only to a platform, e.g., a vehicle body. The pre-assembled unitary lift gates may also be configured to allow multiple units to be stacked together to facilitate shipping and storage. The lift gate may be fully assembled and tested prior to being secured to the vehicle body. The features of the invention allow the lift gate to be installed and easily adjusted in significantly less time than any prior art cantilever lift gates.

While certain embodiments of the present invention are shown in the drawings and described above in detail, it should be understood that there is no intention to limit the invention to the specific form or forms disclosed. On the contrary, the intention is to cover all modifications, alternative constructions, and equivalents falling within the spirit and scope of the invention. The present invention is limited only by the claims that follow.